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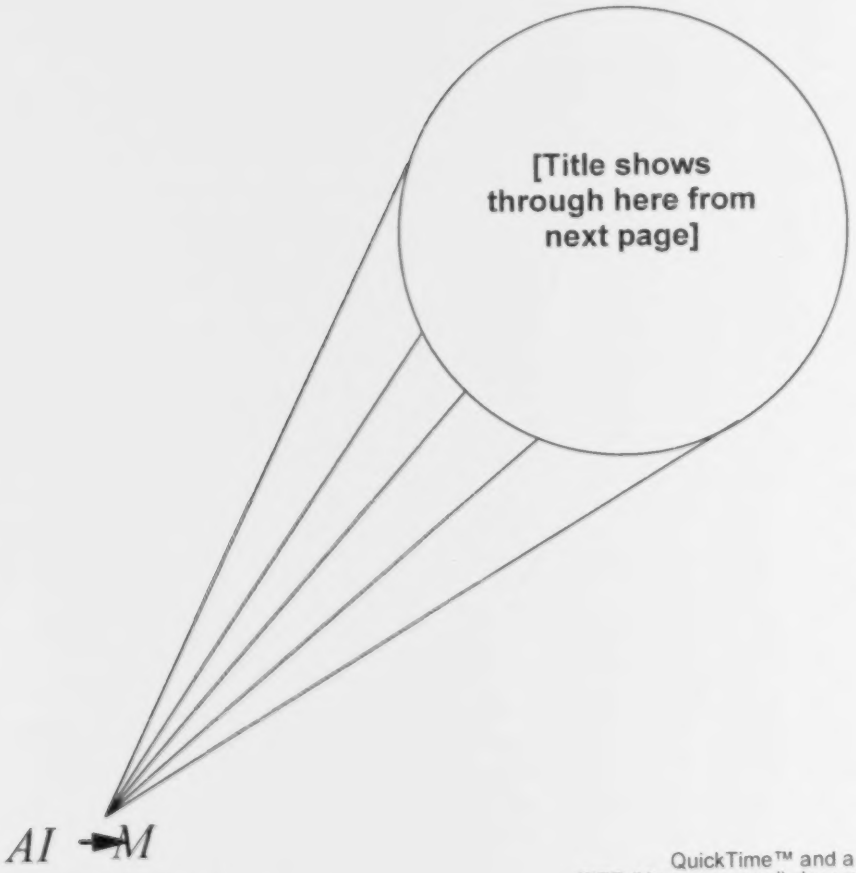

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Extensions to Systematic Error and Risk Analysis (SERA) Tool

- Final Report -

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Abstract

The Systematic Error and Risk Analysis (SERA) tool is software developed by AIMDC for DRDC Toronto and designed to step accident investigators through a systematic process of identifying factors that led to an accident and associated pre-conditions. The present contract work added new features to the SERA tool, principally the ability for investigators in the field to dictate remarks for later inclusion in a SERA report. The purpose of voice recording is to reduce the need for the more cumbersome use of a stylus to enter textual responses. Support was added to SERA that accepts text recorded on a Sony IC Voice Recorder and transcribed by the Dragon NaturallySpeaking software. The SERA software manages the insertion of the transcribed text into appropriate locations in the SERA interface. Also implemented was a feature that allows users to exclude selected items from an exported SERA report. A final addition to the software allows investigators to review their audio recordings for accuracy in the transcriptions.

Résumé

L'outil Analyse systématique des erreurs et du risque (SERA) est un logiciel mis au point par AIMDC pour le compte de RDDC Toronto. Il est conçu pour faire suivre aux enquêteurs d'accident les étapes d'un processus systématique de l'identification des facteurs qui ont conduit à un accident et aux préconditions connexes. Les travaux effectués en vertu de ce contrat ont ajouté de nouvelles fonctions à l'outil SERA, principalement l'aptitude des enquêteurs sur le terrain à dicter des remarques à inclure plus tard dans un rapport SERA. L'enregistrement de la parole a pour but de réduire le besoin peu pratique d'utiliser un stylet pour entrer des réponses en texte. L'outil SERA a été enrichi d'une fonction qui accepte un texte enregistré sur un enregistreur de voix Sony IC et transcrit par le logiciel Dragon Naturally Speaking. Le logiciel SERA gère l'insertion du texte transcrit dans les endroits appropriés dans l'interface SERA. Il y a eu également une fonction qui permet les utilisateurs à exclure des éléments sélectionnés d'un rapport SERA. Un ajout final au logiciel permet aux enquêteurs d'examiner les enregistrements sonores pour assurer l'exactitude des transcriptions.

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Executive Summary

The Systematic Error and Risk Analysis (SERA) tool is a software package developed by AIMDC for DRDC Toronto. It is designed to step accident investigators through the systematic process of identifying factors that led to an accident and the associated pre-conditions. The process involves answering a series of questions, some of them requiring yes or no responses and others involving extended textual answers.

The present contract involved adding new features to the SERA tool, principally the ability for investigators in the field to dictate remarks for later inclusion in a SERA report. The purpose of voice recording in the field is to reduce the need for the more cumbersome use of a stylus to enter textual responses. To facilitate that process, support was added to accept text recorded on a Sony IC Voice Recorder and transcribed using the Dragon NaturallySpeaking software. Numerical identifiers were added to SERA's interface to allow the software to correlate each dictated entry with a particular text input area in the software. The new "Voice Recognition" window manages the insertion of the transcribed text into appropriate locations in the SERA interface.

A shortcoming in the original software was the inability to specify which components to export to a SERA report, sometimes resulting in the inclusion of extraneous material. To address that issue, an "Export Options" window was added to give users control over the inclusion of the following items: 1) pre-conditions answered, "No"; 2) pre-conditions not answered; and 3) AGA 135 HFACS equivalents.

A final addition to the software arose from a study that examined the feasibility of including a mechanism by which investigators could review their audio recordings for accuracy in the transcriptions. As a consequence of that study, it was decided that such a capability could be designed and implemented in the context of the current contract. The new "Audio File Access" window presents users with a list of available audio files and displays their associated numeric identifiers, revealing the correlation between each text input area and each audio file. Users may then select one and click "Play" to open the file with standard audio playback controls.

Sommaire

L'outil Analyse systématique des erreurs et du risque (SERA) est un logiciel mis au point par AIMDC pour le compte de RDDC Toronto. Il est conçu pour faire suivre aux enquêteurs d'accident les étapes d'un processus systématique de l'identification des facteurs qui ont conduit à un accident et aux préconditions connexes. Le processus consiste à répondre à une série de questions dont certaines devaient être répondues par oui ou par non et d'autres nécessitant des réponses plus élaborées.

Les travaux effectués en vertu de ce contrat ont ajouté de nouvelles fonctions à l'outil SERA, principalement l'aptitude des enquêteurs sur le terrain à dicter des remarques à inclure plus tard dans un rapport SERA. L'enregistrement de voix sur le terrain a pour but de réduire le besoin peu pratique d'utiliser un stylet pour entrer des réponses textuelles. Pour faciliter ce processus, l'outil SERA a été enrichi d'une fonction qui accepte un texte enregistré sur un enregistreur de voix Sony IC et transcrit par le logiciel Dragon Naturally Speaking. Des identificateurs numériques ont été ajoutés à l'interface de l'outil SERA pour permettre au logiciel de corréler chaque entrée dictée avec une zone d'entrée de texte particulière dans le logiciel. La nouvelle fenêtre de reconnaissance de voix gère l'insertion du texte transcrit dans les endroits appropriés de l'interface de SERA.

Le défaut de l'ancien logiciel était, entre autres, son incapacité de préciser quels composants il fallait exporter à un rapport SERA. Cela entraînait parfois la présence de matériel étranger dans le rapport. Pour remédier à ce problème, une fenêtre « Export Options » a été ajoutée pour permettre aux utilisateurs de contrôler l'insertion des éléments suivants : 1) réponses « non » aux préconditions; 2) pas de réponses aux préconditions et 3) équivalent au AGA 135 HFACS.

Un dernier ajout au logiciel a été suggéré par une étude de la possibilité d'inclure un mécanisme selon lequel les enquêteurs pourraient examiner leurs enregistrements de son pour assurer l'exactitude des transcriptions. En raison de cette étude, il a été décidé qu'une telle capacité pourrait être désignée et appliquée dans le contexte du présent contrat. La nouvelle fenêtre « Audio File Access) présente aux utilisateurs une liste de fichiers sonores disponibles et affiche le numéro de leur identificateur numérique, révélant la corrélation qui existe entre chaque zone d'entrée de texte et chaque fichier sonore. Les utilisateurs peuvent choisir alors un fichier et cliquer sur « Play » pour l'ouvrir à l'aide des contrôles de lecture.

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Background

The Systematic Error and Risk Analysis (SERA) tool is a software package developed by AIMDC for DRDC Toronto. It is designed to step accident investigators through the systematic process of identifying the factors that led to an accident and the associated pre-conditions. The process involves answering a series of questions, some of them requiring yes or no responses and others involving extended textual answers.

The software is implemented in Java for Windows, Macintosh and the Pocket PC platforms. Hardware used for the Pocket PC is the Compaq iPaq running under the Microsoft Pocket PC 2002 operating system. The Pocket PC version of SERA is designed to be used by accident investigators in the field. Prior to the current work, Pocket PC users entered textual information using a stylus, an often tedious process. A need was identified to simplify that entry procedure and became a key element of the work in the current contract.

Another shortcoming in the software was the inability to select the components exported to a SERA report. Providing users with the ability to customise that output was another task identified for inclusion in this contract.

Research Approach

Study Objectives and Work Items

The following study objectives and work items were identified for this project:

Construct an interface to take natural speech as input at locations in SERA where elaboration, explanation and comment are required, convert that audio input into text files with associated tags to appropriate locations in SERA and integrate the results with SERA's report facility.

Offer users the option to eliminate some of results currently included in SERA reports, which tend to add clutter when users do not wish to see them. Specifically, users will be given the option of eliminating the following: 1) pre-conditions answered, "No"; 2) pre-conditions not answered; and, 3) AGA 135 HFACS equivalents. Opting for any of those should delete them from the report only, not from the main SERA file.

Conduct an investigation into the feasibility of associating the audio files with the various interface locations to allow users to review the speech recognition results while playing back their recordings.

Looking ahead to the establishment of SERA as a recognised tool for accident investigation, a determination needs to be made about what reliability test(s) might be appropriate to help in establishing its credibility. Conduct an investigation into available non-parametric tools to set the stage for a formal test of the software.

Optionally, refine SERA based on the results of field evaluations that yield recommendations that affect the look and feel of SERA. The scope of any changes to SERA arising from the results of field evaluations will be limited to editing textual information in SERA and will not involve the decision logic or screen design.

Voice Recording and Speech Recognition

One of the primary aims of the current contract was to allow investigators to record speech in the field and later incorporate those remarks as text in the appropriate locations in a SERA report. That required several elements:

- selection of a suitable hardware device for recording in the field;
- selection of software for transferring and transcribing the recorded audio content onto a computer;
- specification of guidelines for recording the audio so that it can be linked to specific locations in a SERA report;
- construction of an interface within SERA for accepting the transcribed text and inserting it into the appropriate locations;
- possible implementation of a method for reviewing the recorded audio files.

Those elements are described in detail in the following sections.

The Sony Voice Recorder Hardware

The Sony IC Voice Recorder was selected as the means for investigators to store dictated remarks. The device allows users to record high quality audio onto a storage card ("Memory Stick") in much the same way as a tape recorder is used. It is very compact, making it suitable for dictating notes in the field for later retrieval. Because the device has no moving parts, recordings feature less noise than those made with conventional tape recorders, and the electronic storage mechanism allows entries to be indexed and transferred easily to a computer. Audio on the computer then can be converted to editable text using voice recognition software.

With the included 8 MB storage card, the recorder can store 64 minutes of audio; with a 128 MB card (the largest available), the device will record over 17 hours of material.

In addition to offering the advantages described above, the Sony IC Voice Recorder was selected because it includes software that handles the transfer of audio files to a computer and subsequent transcription of the recorded speech into editable text.

The Voice Editor Software

The Sony Memory Stick Voice Editor software is bundled with the voice recorder hardware. It allows users to transfer audio files to and from a Windows computer and to listen to them using standard playback controls. It also provides users with a direct link to the Dragon NaturallySpeaking voice recognition software.

Instructions for installing the Memory Stick Voice Editor appear in Annex 1.

Dragon NaturallySpeaking Software

Like the Voice Editor software, the Dragon NaturallySpeaking software is bundled with the Sony voice recorder. It provides the speech recognition capabilities that allow remarks dictated in the field to be transcribed for insertion into a SERA report.

The voice recognition software must be trained to recognise a user's voice before it can be used. That process involves reading one or more passages of text into the Sony Recorder for at least fifteen minutes, although reading for longer does improve the accuracy of recognition. At the end of the training session, the software analyses the sound of the voice, correlating it with the text of the passage read. Because the software learns the characteristics of individual voices, training must be performed separately for each user of the software. Further training can be done later to improve the accuracy of recognition.

At least one passage of text must be read for a minimum of 15 minutes. Testing by AIMDC has revealed that significantly higher accuracy can be achieved by training the software with two passages, so it is recommended that users read at least two 15 minute sections.

Instructions for installing and training the Dragon software appear in Annex 1.

Recording Dictated Entries

A key requirement for speech input to SERA was the ability to link spoken entries with specific text input areas in the software. That was accomplished using a numerical identifier scheme whereby each text input area has a unique number displayed next to it in square brackets, which a user records at the beginning of each dictated entry. Most text input areas in SERA are sequentially numbered, but there are apparent gaps in the numbering depending on which branches of the tree a user follows during the investigation of a given accident.

Numerical identifiers were chosen over alphabetical or alphanumeric because the voice recognition software has difficulty distinguishing certain letters from words, e.g., the letter "C" and "see." Also, numeric entry is flexible enough that, for example, the number "259" can be entered by saying either "two hundred and fifty-nine" or "two five nine."

Although the target platform for field investigators is the Pocket PC, numerical identifiers were added to SERA's interface on all three supported systems, giving users the option to use a Windows or Macintosh laptop in conjunction with the voice recorder.

The process of conducting a SERA investigation in the field begins with a user launching SERA on the Pocket PC. The investigator navigates through the SERA process, answering "yes" or "no" to questions, as appropriate, and selecting conclusions and pre-conditions, but without filling in any extended textual information.

Several text boxes in the first two SERA screens do not have identifiers because they require short input and often contain proper names. The Dragon software is less effective with such input, so it was decided that those text boxes should be filled in manually using the on-screen keyboard on the PDA.

Each recorded entry must begin with a section sign symbol (§), which serves as a separator between entries. This was chosen as a symbol that would not be used in a typical investigation and therefore would not lead to ambiguity when the text is read into SERA.

After the section sign, the numerical identifier of the text entry area is recorded, followed by the content of the remark to be added to the report. For example, to record the remark, "the plane was flying too low" for insertion in text box 19, the user would say the following: "Section sign nineteen the plane was flying too low period."

Punctuation and formatting commands can be used to achieve the best possible recognition results. Those are discussed further in Section V of Annex 1, entitled "Special Dictation Commands."

"Voice Recognition" Window

The "Voice Recognition" window (see Figure 1) was implemented to provide an interface that allows transcribed text to be input into SERA. It is invoked using the "Import Speech..." command in the "File" menu.

The window works by receiving recognised text from the Dragon software into a large text input area. That text constitutes all of the dictated remarks along with their section numbers. When the user clicks the "Insert" button, the text is separated into individual remarks and inserted into the appropriate places in the SERA interface.

If SERA encounters a problem interpreting a section number, the user will be notified in the window and can then manually copy and paste the affected text into suitable places in SERA's interface. The recognition software was so effective, however, that the problem never arose during AIMDC testing.

The "Voice Recognition" window includes a "Save Transcript..." command in the "File" menu for storing a copy for future reference. There is an "Open Transcript..." command to call up previously saved material.

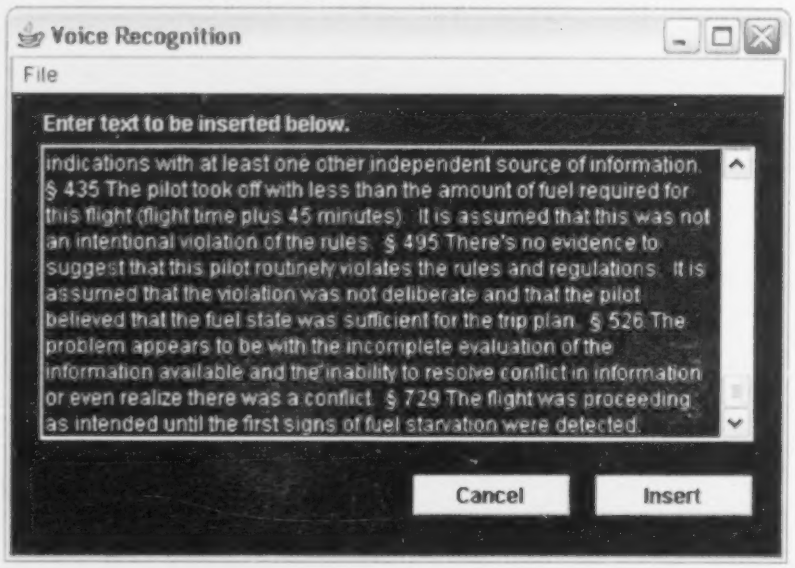
Voice Recognition
File
Enter text to be inserted below.
indications with at least one other independent source of information. § 435 The pilot took off with less than the amount of fuel required for this flight (flight time plus 45 minutes). It is assumed that this was not an intentional violation of the rules. § 495 There's no evidence to suggest that this pilot routinely violates the rules and regulations. It is assumed that the violation was not deliberate and that the pilot believed that the fuel state was sufficient for the trip plan. § 526 The problem appears to be with the incomplete evaluation of the information available and the inability to resolve conflict in information or even realize there was a conflict. § 729 The flight was proceeding as intended until the first signs of fuel starvation were detected.
Cancel
Insert

Figure 1: "Voice Recognition" window

"Audio File Access" Window

The current contract included a requirement to examine the feasibility of allowing users to review the audio files associated with each transcribed entry in the SERA interface. Having determined that it was feasible to implement such a capability and given the delay in obtaining material from the inter-rater reliability contractor, it was decided after discussions with the client that implementing the audio file review would constitute a substitute for the inter-rater reliability component of the contract. Furthermore, the current report is to serve as a substitute for the report on the inter-rater reliability study.

The "Audio File Access" window was designed to allow users to listen to their original audio recordings to resolve discrepancies with the recognised text. It is invoked using the "Voice Recorder Files" command in the "File" menu.

Given the high accuracy of the speech recognition software experienced by AIMDC during testing, it should be assumed that the review procedure the review procedure will be used only rarely. Reading over the recognised text should be sufficient to catch any errors in the majority of cases.

The "Audio File Access" window presents a list of audio files with section numbers in parentheses. Those section numbers are inferred based on SERA's interpretation of the transcribed text. If there were errors recognising the numerical identifiers during transcription, the parenthesised numbers might not be accurate, but would indicate the approximate location of the desired audio file.

After selecting a file, users can click the "Play" button to open the file in the Sony Memory Stick Voice Editor software where it can be reviewed using standard audio playback controls.

Instructions for using the "Audio File Access" window appear in Annex 1.

Customised Report Output

A need was identified for investigators to be able to customise some of the results currently included in exported SERA reports, which tend to add clutter if a user does not explicitly wish to see them. Specifically, options were added that allow users to include or exclude the following from a report:

1) pre-conditions answered, "No;"

2) pre-conditions not answered;

3) AGA 135 HFACS equivalents.

The options are presented to the user in the "Export Options" window.

"Export Options" Window

To address the need for customised report output, a new "Export Options" window was created (see Figure 2). That window is displayed when the user selects "Export..." from the "File" menu. The window contains a checkbox for each of the three settings described in the previous section. By default, all checkboxes are selected the first time the window is displayed during a given session, and the state of the window is preserved each time it is displayed during that session.

The "Export Options" window was added to all three platforms that currently support SERA: Windows, Macintosh and Pocket PC.

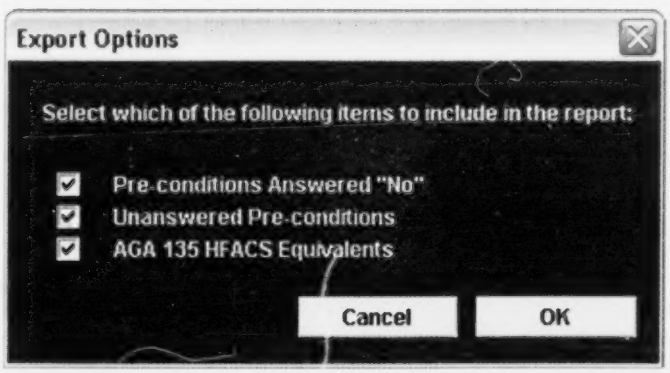

Figure 2: "Export Options" window

Opportunities for Future Enhancements

Future work on the software could encompass some or all of the following items.

Voice Recognition on the Pocket PC

The Pocket PC version of SERA could be extended to allow recognition of spoken commands for navigation through the questionnaire. That could allow selection of yes or no answers and choosing conclusions and pre-conditions, thereby reducing the need for investigators to use a stylus.

As PDA technology improves, it likely will be possible for the work using the Sony IC Voice Recorder to be incorporated into the PDA itself. While voice input in the field improves the ease with which an investigation can be conducted, it still requires the use of two handheld devices. Using only one device will be a further improvement for investigators. Before that can happen, however, PDA's will have to acquire the capacity for storing larger amounts of audio and for interpreting audio files.

Palm Support

A port of the software could be prepared for the PalmOS platform.

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Annexes

1. Instructions for Voice Input with the SERA Accident Investigation Tool
2. Installing SERA on the Pocket PC
3. SERA Source Code Files

Annex 1

Instructions for Voice Input with SERA

Annex 1: Instructions for Voice Input with the SERA Accident Investigation Tool

I. Overview

The voice recording and recognition capabilities of a Sony IC Recorder and associated software allow users of the SERA accident investigation tool to dictate comments in the field during an accident investigation, thereby avoiding the tedious process of keying information into a mobile device.

SERA users still navigate through the SERA questionnaire, answering yes/no questions and selecting appropriate conclusions and pre-conditions. However, extended textual answers and additional remarks can be dictated into the voice recorder for later integration into a SERA report.

The next section describes how to use the Sony IC Voice Recorder to dictate text into SERA. The process involves the following steps:

- Create a SERA File
- Record Dictated Entries
- Convert Dictated Entries to Text
- Merge Converted Text with the SERA File
- Optional Review of Audio Files
- Save and Export a Report
- Integration of Exported Reports with Other Documents

Section III describes the installation and configuration of the software required for voice recognition. Section IV discusses voice recorder hardware issues and Section V presents a summary of special punctuation and formatting commands recognised by the dictation software.

II. Detailed Instructions

If you have not trained your Sony IC Recorder to recognise your voice, go to Section III and follow the instructions for training up your Recorder. If you have trained your Sony Recorder then continue with the instructions below:

- **Create a SERA File**
  - While in the field, you, as an investigator, will navigate through the SERA process on a PDA, answering yes or no to questions, as appropriate, selecting conclusions and pre-conditions, but without filling in any extended textual information;
  - Most text entry areas in the software are labelled with unique numerical identifiers enclosed in square brackets. Those numbers enable the software to associate each spoken

entry with a particular text entry area ("text box") in the SERA interface. Several text boxes in the first two SERA screens do not have identifiers because they require short input, often containing proper names. The Dragon software is less effective with such input, so it was decided that those text boxes should be filled in manually using the on-screen keyboard on the PDA. Those should be filled in at this stage of the process;

- At the end of the process, the resulting SERA file should be stored on the PDA for later retrieval. To store the file, use the "Save As..." command in SERA's file menu.

- **Record Dictated Entries**
  - While creating a SERA file, questions requiring more than short responses may be answered most easily by dictating entries into the Sony Voice Recorder (Before using your Sony IC Recorder, make sure you have reviewed the two short notes in Section IV below on the "Care and Feeding of the Sony IC Voice Recorder");

  - Each voice entry is associated with a unique numerical code, recorded at the beginning of each dictated section, that correlates with a particular number in square brackets in the interface;
    Most text boxes in SERA are sequentially numbered, but you will notice apparent gaps in the numbering depending on which branches of the tree you follow during the investigation of a given accident;

  - Set the recorder for "SP" (high quality) recording and use the "Low" sensitivity microphone setting. Dictate holding the unit two to four inches from your mouth;

  - Each recorded entry must begin with a section sign symbol (§), which serves as a separator between entries. After the section sign, the numerical identifier of the text entry area must be recorded, followed by the content of the remark to be added to the report. For example, to record the remark, "the plane was flying too low" for insertion in text box 19, say the following: "Section sign nineteen the plane was flying too low period;"

  - Carriage returns can be added by saying "new line" and commas are inserted with the "comma" command. Users who are new to voice recognition often omit commands during dictation, resulting in missing punctuation and formatting. To achieve the best possible recognition results, it is recommended that you familiarise yourself with those commands, discussed further in Section V, "Special Dictation Commands;"

  - Identifier numbers, such as "259," can be entered either by saying "two hundred and fifty-nine" or "two five nine;"

  - Each entry should be recorded in a separate file on the voice recorder. Press and release the "Rec/Rec Pause" button to start each recording and the "Stop" button when each one is finished;

  - If you want to add more to an entry later, you can create a new audio recording having the same numerical identifier with the additional material. When the entries are imported into SERA, the software will merge them into a single text area, as appropriate;

  - It is recommended that you create a separate folder on the voice recorder for each accident under investigation. Folders can be created using the "New folder" command in

the menu. This process is described in more detail on page 37 of the Sony IC Recorder manual.

- **Convert Dictated Entries to Text**
  - Move the SERA file from the PDA to a desktop or laptop computer using the following procedure:
    - Place the PDA in its cradle connected to your desktop or laptop Windows computer;
    - Open "My Computer" from the Start menu on the laptop or desktop machine and then open "Mobile Device;"
    - You will see a list of folders on the PDA and the SERA file should be located in one of those folders. Drag the SERA file to a folder on the laptop or desktop machine.
  - Launch SERA and open the file that you just moved;
  - Select "Import Speech..." from the File menu;
  - Plug the Sony voice recorder into the computer's USB port using the supplied cable and launch the "Memory Stick Voice Editor" from the Start menu (if you have a USB hub, see the note at the end of this sub-section);
  - The files on the voice recorder will appear in a list in the window and can be previewed to find those that are to be read into SERA. Select all the relevant files by shift-clicking or control-clicking;
  - Press the "Voice Recognition" button at the bottom-right corner of the window (it looks like a document with the letters "ABC" superimposed). This will launch the Dragon speech recognition software;
  - In the next dialogue box, choose to transcribe into "A selected window" and click the "Transcribe" button;
  - You will then be prompted to click in a window to receive the transcribed text. Select the SERA "Voice Recognition" window, either in the Taskbar or by clicking the window if it is visible. The text will appear in that window as it is transcribed. The transcription usually takes between 5 and 15 minutes for a modest input for a single unsafe act;
  - When recognition (transcription) has finished, you may use the "Save Transcript..." command in the File menu to store a copy for future reference. You also may use "Open Transcript..." to call up previously saved material;
  - The USB connection for the voice recorder may not be compatible with all USB hubs and in those cases must be plugged directly into a USB connection of the computer. If there is only one available connection, it will need to be shared between the PDA and the voice recorder. If that is the case, connect the PDA first and transfer the SERA file created in the field (the process is described above). Then disconnect the PDA and connect the voice recorder to carry out the audio file transcription.

- **Merge Converted Text with the SERA File**
  - When the recognition process has finished, click the "Insert" button in the "Voice Recognition" window to instruct SERA to insert the text into the appropriate places in the report;
  - If SERA no section sign identifier problems are encountered, the "Voice Recognition" window will close and the text will have been inserted into the SERA file;
  - If errors were found in the transcribed text, the affected entries will appear in the window so that they can manually be cut and pasted into the appropriate text boxes in the SERA file.

- **Optional Review of Audio Files**
  - Some entries may contain errors and on occasion you may need to listen to the original audio recordings to resolve discrepancies. This can be done using the "Voice Recorder Files" command;
  - Given the high accuracy of the speech recognition software, you may find that you use this procedure only rarely. Simply reading over the recognised text normally is sufficient to catch any errors;
  - To review the original audio recordings, select the "Voice Recorder Files..." item in SERA's File menu. That will bring up a window with a list of audio files;
  - If the voice recorder is connected to the computer, the list will show files on that device;
  - Otherwise, you can specify a folder containing your audio files using the "Select Folder" button, which will invoke a standard file selection dialogue box. Navigate to the folder with your audio files and double-click any file in that folder to tell SERA where your audio files are located;
  - If you have inserted the transcribed text into the SERA file, the software will be able to correlate the numbered entries with the audio files containing them. The section identifier will appear in the file list in parentheses after the file name. If there were errors recognising the numerical identifiers during transcription, the parenthesised numbers may not be accurate, but will indicate the approximate location of the desired audio file;
  - Select a file from the list and click the "Play" button to open it in the Sony software, where it will appear in a window with standard audio playback controls;
  - It is common for users who are new to voice recognition to omit commands during dictation. Typical errors include not recording periods and commas, capitalisation and carriage returns. Those commands are discussed in greater detail below in the section, "Special Dictation Commands."

- **Save and Export a Report**
  - The SERA file is now complete and should be saved for future reference;
  - A report of the complete SERA file now may be exported in text form for integration with other investigation documents.

III. Configuration of the SONY and Dragon Software

The Sony IC Recorder allows users to record high quality audio onto a storage card ("Memory Stick") in much the same way as a tape recorder is used. It is very compact, making it suitable for dictating notes in the field for later retrieval. Because the device has no moving parts, recordings feature less noise than those made with conventional tape recorders, and the electronic storage mechanism allows entries to be indexed and transferred to a computer easily. Audio on the computer then can be converted to editable text using voice recognition software.

With the included 8 MB storage card, the recorder can store 64 minutes of audio and with a 128 MB card (the largest available), the device will record over 17 hours of material.

- **Installing the Sony IC Recorder Software on your PC**

In order to use the Sony IC Recorder with SERA, it is necessary to install the software that came with the unit. That includes the Sony Memory Stick Voice Editor for retrieving and playing back audio files stored on the device and the Dragon NaturallySpeaking software for converting recorded speech into editable text on the computer. Insert the Memory Stick Voice Editor installation CD. It should launch automatically, but if it does not, run "Setup.exe". Follow the instructions on your screen to complete the installation.

- **Installing the Dragon Speech Recognition Software**

Next, insert the Dragon NaturallySpeaking installation CD, which will either launch automatically or you must manually run "Setup.exe". Follow the on-screen installation instructions. Once it has been installed, the training process begins.

- **Training the Speech Recognition Software**

The voice recognition software must be trained to recognise your voice before it can be used. That process involves reading one or more passages of text into the IC Recorder for at least fifteen minutes, although reading for longer can improve the accuracy of recognition. At the end, the software will analyse the sound of your voice, correlating it with the text of the passage read. Because the software learns the characteristics of individual voices, training must be performed separately for each user of the software. Further training can be done later to improve the accuracy of recognition.

First, the software will prompt you to specify a user name for your individual settings. The next window will be the "New User Wizard." Select your language and vocabulary and for "Dictation Source," select "Sony Memory Stick IC recorder ICD-MS Series." The next window will present a selection of passages that may be read for training. At least one passage must be read for a minimum of 15 minutes. It is recommended that at least two passages be read as training to achieve higher accuracy.

Passages must be read into the voice recorder, and it must be disconnected from the computer to do so. Press the "Rec/Rec Pause" button to begin recording and press the "Stop" button at the end. When reading a passage, do not say "comma," "period" or any other punctuation commands. Hold the microphone on the recorder 2 to 4 inches from your mouth.

When you have finished the first passage, you will be instructed to connect the voice recorder to the computer and find the file using the Memory Stick Voice Editor software. Select the file and click the "Voice Recognition" button to send the recording to the Dragon software for analysis.

- **Possible Problem**

Note that before the training process is complete, the online help may not be available. Full manuals for the Dragon software can be found in the "Enx" folder inside the "Docs" folder on the CD-ROM. They also are available on the Dragon website at <http://support.scansoft.com/manuals/>.

- **Next Steps**

Now that you have trained your Sony IC Recorder to recognise your voice, you are ready to conduct an accident investigation using SERA. You will create a SERA file, record any lengthy comments, explanations, notes, etc. into your Sony IC Recorder, merge those with the base SERA file on your PC and produce a report.

To continue with that process, return to Section II above and proceed to the first step of creating a SERA file.

IV. Care and Feeding of the Sony IC Voice Recorder

- The Sony voice recorder requires 2 "AAA" alkaline batteries (do not use manganese batteries). For maximum battery performance, use high-capacity alkalines, such as "Duracell Ultra" or "Energizer e2" batteries. Batteries will last for approximately 10 hours of recording. After removing old batteries, insert new ones within three minutes in order to preserve the clock settings. It is recommended that fresh batteries be installed prior to using the recorder for a SERA investigation. More information on batteries can be found on pp. 10-11 of the Sony manual.

- The voice recorder can store 999 entries in a single folder. That should be more than enough storage for the typical accident investigation. For maximum flexibility, it is recommended that the unit be cleared of audio recordings prior to initiating an investigation.

V. Special Dictation Commands

There are a number of commands that can be used during dictation for generating punctuation, special symbols and capitalisation. Below is a partial list and more can be found in the on-line help for the Dragon software under "Dictation."

To produce:	Speak the command:
.	Period
,	Comma
-	Hyphen
/	Slash
" "	Open quote, close quote
'	Apostrophe
;	Semi-colon
:	Colon
( )	Open parenthesis, close parenthesis
[ ]	Open bracket, close bracket
@	At sign
?	Question mark
!	Exclamation mark
Carriage return	New line

The Dragon software automatically capitalises the first letter of each sentence, with the exception of the first sentence following the section identifier. SERA automatically capitalises that during import, so it is not necessary to use any special commands for sentence capitalisation as long as you make sure to say "period" at the end of each sentence. The Dragon software will capitalise many proper names automatically, but sometimes it may be necessary to explicitly indicate that a word is capitalised using the "Cap" command (e.g., for "Air Canada," since "air" would not be identified as a proper name). To enter all capitals, say "All-caps on" and "All-caps off" before and after the capitalised text. Abbreviations, such as "AGL," can be entered using the "Spell mode on" and "Spell mode off" commands.

Words that are not recognised by the software can be added to its vocabulary using the "View/Edit" command in the "Words" menu of the Dragon toolbar. That will allow you to enter words and optionally train them, particularly if they are not pronounced the way their spellings would suggest.

Annex 2

Installing SERA on the Pocket PC

Annex 2: Installing SERA on the Pocket PC

The components of SERA for Pocket PC are contained in a compressed ZIP archive called "SERA_PDA.zip" that includes the following files:

- SERA.jar: The SERA application as a JAR (Java archive) file
- SERA: A shortcut file that enables SERA to be launched from the PDA's Start Menu
- Installation.pdf: This document containing installation instructions

Part 1: Install the "Jeode" Java Runtime Software

- Connect the Pocket PC to the Windows machine (i.e., a laptop or desktop computer). This requires installing the Microsoft ActiveSync software and establishing a hardware connection between the units. Follow the directions that came with the Pocket PC device.
- If the device has never been synchronised, there will be a prompt to set up a partnership. If a permanent partnership is not required, select "Guest." Otherwise, follow the directions for establishing a permanent partnership.
- The "Jeode" Java runtime software is bundled with some Pocket PC devices. Check the CD-ROM that came with the unit for the Jeode installer. If it was not included with the PDA, it can be acquired from the following web site:
- http://www.handango.com/PlatformProductDetail.jsp?productId=59096
- From the Windows machine, launch the Jeode installer. Follow the instructions in the installer and, when prompted for the directory, choose to install it into the default directory. If the installer has been run before, it may display a prompt to remove the software. If this happens, continue with the removal and then launch the installer again to complete the installation.
- After installation, there will be a standard prompt to check the mobile device for any additional instructions, but no further steps will be required on the Pocket PC.

Part 2: Install the SERA Application and Shortcut

- Decompress the "SERA_PDA.zip" archive and open the resulting "SERA_PDA" folder.
- With the Pocket PC connected to the laptop or desktop computer (see the first and second bullets in Part 1), open "My Computer" on the Windows machine (from the Start menu or by double-clicking the desktop icon).
- In the "My Computer" window, open the "Mobile Device" and then open the "My Pocket PC" folder.

- Drag the SERA application ("SERA.jar") from the "SERA_PDA" folder into the "My Pocket PC" folder.
- If a "File Conversion" alert appears, click "OK."
- To install the shortcut in the PDA Start Menu: In the "My Pocket PC" window (which should still be visible) open the "Windows" folder and then the "Start Menu" folder.
- The "SERA_PDA" folder contains a special shortcut file called "SERA". Drag that file into the "Start Menu" folder.
- [Note that this special shortcut file includes information that runs the Jeode software at the same time SERA is launched and, because of that requirement, SERA will not run if a new shortcut is created.]
- If a "File Conversion" alert appears, click "OK."
- Installation is complete and the Pocket PC can be disconnected from the computer. SERA can now be launched from the Start Menu on the Pocket PC.

Note: Subsequent upgrades to SERA can be applied by performing only the first five steps of Part 2.

Annex 3

Source Code Files

Annex 3: SERA Source Code Files

Windows and Macintosh Versions

Collage.jpg

- This image file contains the collage that is displayed on the splash screen.

Dialogs.java

- This file contains the Java code for the dialogue boxes, including the HFACS window, the help prompt, the pop-up help windows and the "save changes" prompt.

Flowchart.java

- This file contains the Java code necessary for the SERA Flowchart window.

Main.java

- This file contains the Java code that serves as the main entry point when the application is launched.

MainWindow.java

- This file contains the Java code necessary for the main SERA window.

SERA.mcp

- This is the Metrowerks CodeWarrior project file.

Tab.jpg

- This image file contains the graphic of the tab used for the numbered unsafe acts in the flowchart window.

TabSel.jpg

- This image file contains the graphic of the tab used for the currently selected unsafe act in the flowchart window.

Title.jpg

- This image file contains the graphic of the SERA title that is displayed above the collage on the splash screen and at the top of all subsequent screens.

Tree.txt

- This file contains the text of questions, conclusions and pre-conditions, as well as information on the relationships among the nodes in the SERA decision tree.

Pocket PC Version

Credits.jpg

- This image file contains the graphic of the developer credits screen.

Dialogs.java

- This file contains the Java code for the dialogue boxes, including the HFACS window, the help prompt, the pop-up help windows and the "save changes" prompt.

Flowchart.java

- This file contains the Java code necessary for the SERA Flowchart window.

Main.java

- This file contains the Java code that serves as the main entry point when the application is launched.

MainWindow.java

- This file contains the Java code necessary for the main SERA window.

SERA.bat

- This is an MS-DOS batch file which compiles the Java code and builds the application.

Splash.jpg

- This image file contains the graphic of the splash screen.

Tab.jpg

- This image file contains the graphic of the tab used for the numbered unsafe acts in the flowchart window.

TabSel.jpg

- This image file contains the graphic of the tab used for the currently selected unsafe act in the flowchart window.

Tree.txt

- This file contains the text of questions, conclusions and pre-conditions, as well as information on the relationships among the nodes in the SERA decision tree.

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14. ABSTRACT

The Systematic Error and Risk Analysis (SERA) tool is software developed by AIMDC for DRDC Toronto and designed to step accident investigators through a systematic process of identifying factors that led to an accident and associated pre-conditions. The present contract work added new features to the SERA tool, principally the ability for investigators in the field to dictate remarks for later inclusion in a SERA report. The purpose of voice recording is to reduce the need for the more cumbersome use of a stylus to enter textual responses. Support was added to SERA that accepts text recorded on a Sony IC Voice Recorder and transcribed by the Dragon NaturallySpeaking software. The SERA software manages the insertion of the transcribed text into appropriate locations in the SERA interface. Also implemented was a feature that allows users to exclude selected items from an exported SERA report. A final addition to the software allows investigators to review their audio recordings for accuracy in the transcriptions.

RÉSUMÉ

[to be done].

15. KEYWORDS, DESCRIPTORS OR IDENTIFIERS

(U) HUMAN ENGINEERING TOOLS; HUMAN FACTORS ENGINEERING; SYSTEMATIC ERROR AND RISK ANALYSIS; SERA; ACCIDENT INVESTIGATION; HUMAN FACTORS ACCIDENT CLASSIFICATION SYSTEM; HFACS; AGA 135; MULTIPLE UNSAFE ACTS;; PERCEPTUAL CONTROL THEORY; IP/PCT; INTELLIGENT AIDING; TRACKING INTERFACE ACTIONS; AGENTS; AGENT TECHNOLOGY.